A Quantitative Geoacoustic Technique for Characterizing Marine Sediments

Richard McGee and Judith A. Boughner
Evans-Hamilton, Inc.

Abstract

Cost-effective and rapid means of mapping the distribution of sediments in harbors and rivers are required to facilitate the remediation decisions facing environmental managers. One's ability to manage polluted environments effectively is in part a function of the accuracy of the available site-characterization data. In general, these data should provide accurate descriptions of the physical properties of the sediment,s along with delineation of the lateral and vertical extents of all unique sediment units, contaminated and non-contaminated. In the nearshore environment where contaminated sediments present critical environmental problems, one typically encounters a high degree of sediment variability over relatively small geographic areas. This creates the potential for inappropriate remediation efforts based upon the assumption of widespread sediment homogeneity. A reliable, cost-effective hydroacoustic reflection-profiling technique is available to map a given site accurately, from which an efficient physical sampling program can be developed.

Since most contaminants have an affinity to certain sediment types, detailed acoustic surveys, conducted as quantitative tests rather than for simply generating qualitative images, can provide accurate descriptions of bulk sediment properties. The characteristics of calibrated acoustic reflection data can be correlated to bulk sediment properties such as density, porosity, permeability, mean grain size, and sediment thickness through assessments of acoustic impedance, velocity, and absorption using proven Biot-based analytical techniques.

Habitat Restoration Goal-Setting and Actions—Bellingham Bay Demonstration Pilot Project

Tracey P. McKenzie
Pacific International Engineering

Tom Schadt
Anchor Environmental, L.L.C.

Mike Stoner
Port of Bellingham

Rachel Friedman-Thomas and Lucille Pebles
Washington Department of Ecology

Abstract

The objectives of this paper are to describe the relationship of the habitat restoration element of the Bellingham Bay Demonstration Pilot Project to other key elements of the Pilot Project (i.e., disposal siting, sediment cleanup, source control, aquatic land uses); to describe the process used by the project's Habitat Subcommittee to develop a long-term vision for habitat restoration and mitigation in Bellingham Bay; to identify the range of habitat restoration and mitigation actions and specifically where

these actions could occur; and to identify the mechanism by which these actions were prioritized and integrated into disposal siting, sediment clean up and source control actions. GIS mapping and analysis tools help to illustrate historic and current-day conditions and habitats in Bellingham Bay and to determine priority areas for restoration. Multiple actions, including substrate modification, removal of remnant structures, changing elevations, removing shoreline fills, and restoring eelgrass and kelp are identified as actions that can be integrated and implemented with contaminated sediment disposal and other project elements to achieve the project's process, partnering, and environmental objectives. This paper will also illustrate the partnering required between state, federal, tribal, and local entities to develop a comprehensive vision for short- and long-term habitat restoration and mitigation in Bellingham Bay.

Development of a Bioaccumulation-Based Sediment Cleanup Level for Mercury in Bellingham Bay

Laura Weiss
Washington State Department of Ecology

Clay Patmont
Anchor Environmental

Abstract

Bioaccumulative chemicals in sediments can pose a human health risk via the consumption of contaminated seafood. At the Whatcom Waterway cleanup site in Bellingham Bay, empirical data were used to develop a sediment cleanup level for mercury that is protective of human health.

Historic mercury releases have resulted in a well-defined sediment mercury concentration gradient offshore from the Whatcom Waterway. A similar mercury concentration gradient was also observed in adult male Dungeness crab muscle tissue samples collected within the bay. Several data analysis methods were evaluated. A simple linear regression equation described the relationship between the measured tissue concentrations and the home-range average surface sediment mercury concentration. This empirical sediment-to-tissue regression relationship was also consistent with age-adjusted data for bottomfish.

Using risk assessment techniques, a tissue mercury concentration was calculated to protect tribal fishers who may consume relatively large amounts of seafood from Bellingham Bay. This target tissue concentration was then input into the empirical sediment-to-tissue regression relationship to determine a site-specific, health-based sediment cleanup level for mercury. At the Whatcom Waterway site, areas exceeding the health-based cleanup level generally fell within those areas of the site also targeted for cleanup to address ecological concerns.